DOE/WIPP 02-2225

# Waste Isolation Pilot Plant
# 2001 Site Environmental Report

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# EXECUTIVE SUMMARY

The United States (U.S.) Department of Energy's (DOE) Carlsbad Field Office (CBFO) and Westinghouse TRU Solutions LLC (WTS) are dedicated to maintaining high quality management of Waste Isolation Pilot Plant (WIPP) environmental resources. DOE Order 5400.1, *General Environmental Protection Program*, and DOE Order 231.1, *Environmental, Safety, and Health Reporting*, require that the environment at and near DOE facilities be monitored to ensure the safety and health of the public and the environment. This Waste Isolation Pilot Plant 2001 Site Environmental Report summarizes environmental data from calendar year (CY) 2001 that characterize environmental management performance and demonstrate compliance with federal and state regulations.

This report was prepared in accordance with DOE Order 5400.1, DOE Order 231.1, the *Environmental Regulatory Guide for Radiological Effluent Monitoring and Environmental Surveillance* (DOE/EH- 0173T), and the Waste Isolation Pilot Plant Environmental Protection Implementation Plan (DOE/WIPP 96-2199). The above Orders and guidance documents require that DOE facilities submit an annual site environmental report to DOE Headquarters, Office of the Assistant Secretary for Environment, Safety, and Health; and the New Mexico Environment Department (NMED). The purpose of this report is to provide a comprehensive description of operational environmental monitoring activities, to provide an abstract of environmental activities conducted to characterize site environmental management performance to confirm compliance with environmental standards and requirements, and to highlight significant programs and efforts of environmental merit at WIPP during CY 2001.

WIPP received its first shipment of waste on March 26, 1999. In 2001, no evidence was found of any adverse effects from WIPP on the surrounding environment.

## Introduction

Located in southeastern New Mexico, WIPP is the world's first underground repository permitted to safely and permanently dispose of transuranic (TRU) radioactive and mixed waste generated through the research and production of nuclear weapons and other activities related to the national defense of the United States. TRU mixed waste is TRU waste mixed with hazardous waste regulated under the Resource Conservation and Recovery Act (RCRA). TRU waste consists of material contaminated with more than $3.7\times10^3$ Bq/g (becquerels per gram) (100 nCi/g) of alpha-emitting elements having atomic numbers greater than uranium, the heaviest natural element. Most TRU waste is contaminated industrial trash, such as rags, old tools, sludges from solidified liquids; and glass, metal, and other materials from dismantled buildings.

WIPP's legislative mandate is to demonstrate the safe disposal of TRU wastes from national defense activities and programs. To fulfill this mandate, WIPP has been designed to safely handle, store, and dispose of TRU waste in a fully operational disposal facility. When waste arrives at WIPP, it is placed in excavated storage rooms, carved from rock salt, 655 m (2,150 ft) below the earth's surface. The nature of the salt

is such that after a storage room has been filled, the salt will slowly fill the remaining spaces, thus isolating the waste for thousands of years.

## Environmental Program Information

It is the DOE's policy to conduct its operations at WIPP in compliance with all applicable environmental laws and regulations, and to safeguard the integrity of the southeastern New Mexico environment. This is accomplished through a comprehensive management system consisting of radiological and nonradiological environmental monitoring, environmental compliance, and land management programs, which include wildlife monitoring and the WIPP Raptor Program (WRP). The purpose of these programs is to obtain land use permits, implement selected compliance functions such as National Environmental Policy Act (NEPA) compliance, collect data needed to detect and quantify possible impacts WIPP may have on the surrounding environment and to provide technical support to the DOE's Carlsbad Field Office in the fields of environmental science and land management.

Environmental activities at WIPP generally fall into four categories: collecting environmental samples and analyzing them for a variety of contaminants, preparing and publishing documents showing compliance with federal and state regulations, evaluating whether WIPP activities cause any environmental impacts, and taking corrective action when an adverse effect on the environment is identified.

The WIPP Environmental Monitoring Plan (EMP) (DOE/WIPP 99-2194) outlines the programs that monitor the environment on, and immediately surrounding, the WIPP site. It discusses major environmental monitoring and surveillance activities at WIPP and WIPP's quality assurance/quality control (QA/QC) program as it relates to environmental monitoring.

WIPP's effluent monitoring and environmental surveillance programs are designed to determine adequate protection of the public and the environment during DOE operations, and to ensure that operations comply with the DOE and other applicable federal and state radiation standards and requirements. The Environmental Monitoring Program monitors the pathways that radionuclides and other contaminants could take to reach the environment surrounding WIPP. Pathways monitored include air, ground-water, surface water, soils, sediments, vegetation, and game animals. Groundwater quality and wildlife populations are also monitored. The goal of the program is to determine if the local ecosystem has been impacted during the predisposal and disposal phases of WIPP, and, if so, to evaluate the severity, geographic extent, and environmental significance of those impacts. The Environmental Monitoring Program is conducted in compliance with DOE Orders 5400.1 and 5400.5.

Southeastern New Mexico is home to an abundant array of wildlife. Wildlife species are monitored on the WIPP site to document any population changes that may occur as a result of WIPP activities. Species of special concern, including federally listed threatened and endangered species, receive special consideration when planning WIPP activities that may impact wildlife habitat.

WIPP's Land Management Plan (LMP) was created in accordance with the WIPP Land Withdrawal Act of 1992. This plan identifies resource values, promotes multiple-use management, and identifies long-term goals for the management of WIPP lands. In accordance with its LMP, WIPP follows a land reclamation program and a long-range reclamation plan. WIPP also conducts oil and gas surveillance in the region surrounding the WIPP site to identify new activities associated with oil and gas exploration and production.

## Environmental Compliance

WIPP is required to comply with applicable federal and state laws and DOE Orders.

## Comprehensive Environmental Response, Compensation, and Liability Act

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 U.S.C. 9601 et seq) establishes a comprehensive federal strategy for responding to, and establishing liability for, releases of hazardous substances from a facility to the environment. Through December 2001, no release sites have been identified at WIPP that would require cleanup under provisions of CERCLA.

WIPP submitted the Annual Tier II Emergency and Hazardous Chemical inventory form, required by the Superfund Amendments and Reauthorization Act, on February 22, 2002. The Tier II is submitted to the State Emergency Response Commission (SERC), the Local Emergency Planning Committee (LEPC), and the fire departments with which the CBFO maintains a Memorandum of Understanding (MOU).

## Federal Acquisition, Recycling, and Pollution Prevention

In 1995, WIPP adopted a systematic and cost-effective affirmative procurement plan (APP) for the promotion and procurement of products containing recovered materials. Affirmative procurement is designed to "close the loop" in the waste minimization recycling process by supporting the market for materials collected through recycling and salvage operations.

WIPP continued its recycling program in 2001. Noteworthy pollution prevention (P2) activities completed:

- Chemical Use Reduction
- Reduction of Office Supplies
- Improvements in the Recycling Center

## Resource Conservation and Recovery Act

The RCRA ensures that hazardous wastes are managed from the point of generation through ultimate disposal in a manner that is protective of human health and the environment. The state of New Mexico is authorized by U.S. Environmental Protection Agency (EPA) to implement the provisions of the RCRA in accordance with the New Mexico Hazardous Waste Act. WIPP has a Hazardous Waste Facility Permit (HWFP) from the NMED in accordance with 20.4.1.500 NMAC [New Mexico Administrative Code] and 20.4.1.900 NMAC. The HWFP authorizes the storage of contact-handled (CH) TRU waste in two locations (the Parking Area Unit and Waste Handling Building) and the disposal of CH TRU waste in the three underground Hazardous Waste Disposal Units.

## National Environmental Policy Act

The NEPA requires the federal government to use all practicable means to consider potential environmental impacts of proposed federal projects as part of the decision-making process. The NEPA dictates the public shall be allowed to review and comment on proposed projects that have the potential to significantly affect the environment. The NEPA also directs the federal government to use all practicable means to improve and coordinate federal plans, functions, programs, and resources relating to human health and the environment.

Title 10 *Code of Federal Regulations* (CFR) §1021.331 requires, following completion of each Environmental Impact Statement (EIS) and its associated Record of Decision (ROD), that the DOE prepare a mitigation action plan addressing mitigation commitments expressed in the ROD. DOE Order 451.1B requires DOE facilities to track and annually report progress in implementing a commitment for environmental impact mitigation. To fulfill this DOE Order requirement, the CBFO issued the 2001 Annual Mitigation Report for the Waste Isolation Pilot Plant on July 2001.

## Clean Air Act

The Clean Air Act provides for the preservation, protection, and enhancement of air quality. Under Section 109 of the Clean Air Act, the EPA established the National Ambient Air Quality Standards for six "criteria" pollutants. The initial WIPP emissions inventory was developed as a baseline document to calculate maximum potential hourly and annual emissions of both hazardous and criteria pollutants. The air emissions inventory is conducted biennially and compared to baseline data to identify trends and potential emissions problems. The biennial inventory scheduled for CY 1998 was postponed because conditions at the site were unchanged from the previous inventory. The air emissions inventory for CY 1999 was conducted in 2000. Based on the 1999 air emissions inventory, WIPP operations do not exceed the 10-ton-per-year emission limit for any individual pollutant or the 25-ton-per-year limit for any combination of pollutants.

Based on emission estimates generated in the air emissions inventory, the WIPP site is not required to obtain federal Clean Air Act permits.

WIPP was required to obtain a New Mexico Air Quality Construction Permit for two primary backup diesel generators. During 2001, the generators were operated for approximately 28 of the 480 hours allowed by the permit. There were no malfunctions or abnormal conditions of operations that would cause a violation of the permit.

### Clean Water Act

Section 402 of the Clean Water Act established provisions for the issuance of permits for discharges into waters of the United States. WIPP has no pollutant discharges from point sources and is currently exempt from obtaining a National Pollutant Discharge Elimination System (NPDES) permit.

A permit for Storm Water Discharge Associated with Industrial Activity was issued in 1998. No sampling is required to demonstrate compliance with this permit unless a release occurs. Operational permit compliance activities are limited to quarterly inspections of retention basins, spill containment devices, reclamations sites, and site housekeeping practices.

Quarterly discharge monitoring reports are submitted to the NMED to demonstrate compliance with inspection, monitoring, and reporting requirements as identified in the WIPP Discharge Plan (DP-831) issued by the NMED. Refer to Section 3.2.6 for detailed information.

### Safe Drinking Water Act

The Safe Drinking Water Act of 1974 (SDWA) provides the regulatory strategy for protecting public water supply systems and sources of drinking water. The WIPP water supply is categorized as a nontransient, noncommunity system for reporting and testing requirements. The water supply is sampled ten times every three years for various chemical constituents. Samples were collected in July 2001, and the results were submitted to the NMED. All samples were below action levels as specified by New Mexico monitoring requirements for lead and copper in tap water. The next lead and copper sampling period will be July 2004. Bacterial samples were collected and reported monthly throughout 2001. All results were below SDWA regulatory limits.

### National Historic Preservation Act

The National Historic Preservation Act (NHPA) was enacted to protect the nation's cultural resources and establish the National Register of Historic Places. Federal agencies are required to ensure that historic and cultural properties are given proper consideration in the preparation of NEPA-related documents. No new archeological sites were discovered in 2001.

## Hazardous Materials Transportation Act

The Hazardous Materials Transportation Act is one of the major transportation-related statutes that affects WIPP operations. It provides for the safe transportation of hazardous materials, including radioactive materials. DOE Orders establish packaging and transportation criteria and require DOE field offices to conduct their operations in accordance with all applicable international, federal, state, local, and tribal laws, rules, and regulations governing materials transportation. These DOE Orders also require the development of a transportation plan and use of the DOE TRANSCOM (transportation and tracking communications) system to monitor shipments.

## Packaging and Transporting Radioactive Materials

The WIPP Land Withdrawal Act requires TRU waste containers destined for WIPP to be shipped using specification packagings certified by the Nuclear Regulatory Commission (NRC). Certified shipping containers tor TRU waste satisfy NRC QA requirements. Contact-handled TRU waste will be shipped in TRUPACT-II (Transuranic Package Transporter Model II) and HalfPACT (short Transuranic Package Transporter) containers. Containers for remote-handled waste were certified in 2001.

## Environmental Compliance Assessment Program

The Environmental Compliance Assessment Program plays a major role in the overall program for environmental protection activities at WIPP. The program was developed to determine if facility activities protect human health and the environment and if these activities are in compliance with applicable federal, state, and local requirements; with permit conditions and requirements; and with best management practices. During 2001, WTS environmental compliance assessments identified and implemented a number of improvements.

## Environmental Management System

The WTS Environmental Management System (EMS) received International Organization for Standardization (ISO) 14001 third-party registration on August 5, 1997. Two third-party surveillance audits were conducted in 2001. No nonconformance or findings were identified during the 2001 surveillance period. The EMS registrar recommended continued registration of the WTS EMS.

## Pollution Prevention Committee

WIPP's P2 Committee was formed in 1993. The primary purpose of this committee is to foster recycling activities at WIPP. The committee sponsored activities to raise employee awareness of waste minimization on Earth Day, National America Recycles Day, and during Energy Month (October).

## Environmental Training

Environmental training was provided to personnel associated with environmental operations at WIPP. The WIPP training program has been designed to ensure that personnel performing work are capable of performing their assigned task proficiently. Personnel who perform work that requires special skills or abilities are required to meet the qualification requirements for that specific task unless directly supervised by a qualified person. The WTS Technical Training Section maintains a total of fifteen qualification cards, which are reviewed and updated biennially. This insures that proper adequate training is performed regularly.

## Environmental Radiological Program Information

Radionuclides present in the environment, whether naturally-occurring or from human-made sources, contribute to radiation doses to humans. Therefore, environmental monitoring around nuclear facilities is imperative for characterizing radiological conditions, and for detecting releases and determining their effects, should they occur. The WIPP Environmental Monitoring Program monitors air, surface and groundwater, soils, and biota to characterize the radiation environment and to detect potential releases from WIPP activities. Plutonium-238, $^{239+240}$Pu, $^{241}$Am, $^{60}$Co, $^{90}$Sr, $^{137}$Cs, $^{234}$U, $^{235}$U, and $^{238}$U are monitored because they are components of TRU waste. Potassium-40 is monitored because of possible enhancement in southeastern New Mexico due to potash mining.

## Effluent Monitoring

If radionuclides are released into the environment from WIPP, they would first be detected in airborne effluents. Therefore, WIPP monitors airborne effluents from the facility at three locations. Station A samples unfiltered underground exhaust air, Station B samples unfiltered underground exhaust air in maintenance mode and high efficiency particulate air (HEPA) filtered exhaust air in filtration mode, and Station C samples HEPA filtered air from the Waste Handling Building. Samples were composited monthly or quarterly, in accordance with the Periodic Confirmatory Measurement Protocol for the Waste Isolation Pilot Plant, and analyzed for $^{241}$Am, $^{238}$Pu, and $^{239+240}$Pu.

## Airborne Gross Alpha/Beta

Gross alpha and beta measurements in airborne particulates are used as screening techniques to provide timely information on levels of radioactivity in the environment around the WIPP site. Airborne particulate samples were collected from seven locations around WIPP on a weekly basis. Analysis of Variance (ANOVA) indicated no statistically significant differences between sampling years 2000 and 2001.

### Airborne Particulates

Inhalation of dust particles is the major pathway for the intake of plutonium. Accordingly, plutonium and other radionuclides of interest were determined in air particulate samples around WIPP. There were no statistically significant differences between sampling years 2000 and 2001 for the concentration of any radionuclide in composite air filters.

### Groundwater

Groundwater samples, collected twice in 2001 from seven wells around WIPP, were analyzed for gamma-emitting radionuclides, $^{90}Sr$, and isotopes of uranium, plutonium, and americium. Isotopes of naturally-occurring uranium were detected in every well. The results for the concentrations of uranium isotopes in water samples collected in 2001 were compared with the results from 2000. There was a notable difference in concentrations of uranium isotopes between groundwater samples collected in 2000 and 2001 because of the laboratory's analytical method and counting duration.

### Surface Water

Surface water samples were collected once from each of ten locations around WIPP in 2001. There were no significant differences in concentration of uranium isotopes between years. Large spatial variations in uranium concentrations in surface water are expected because of the different characteristics of the water bodies and the underlying sediments.

### Soil Samples

Soil samples were collected from six locations surrounding WIPP. Samples from each location were collected at three different depths. Measurements of radionuclides in depth profiles provide information about their vertical movements in soil systems. There were no statistically significant differences between sampling years for the concentration of any radionuclide.

### Sediments

Sediment samples were collected from 12 locations around the WIPP site, mostly from the same water bodies from which the surface water samples were collected. There were no statistically significant differences between sampling years 2000 and 2001 for the concentration of any radionuclide.

### Biota

The concentration of radionuclides in plants is an important factor in estimating the intake of individual radionuclides by humans through ingestion. Therefore, rangeland vegetation samples were collected from the same six locations where soil samples were collected. Also collected were muscle tissues from three road-killed deer, two quail, and

one rabbit; species commonly consumed by humans. Fish samples were taken from three different locations on the Pecos River. The whole fish and the muscle tissue from the deer, quail, and rabbit were analyzed for radionuclides (see Section 4.8).

### Environmental Nonradiological Program Information

Nonradiological environmental surveillance programs at WIPP include land management programs (including reclamation of disturbed lands, oil and gas surveillance, and wildlife population monitoring) and meteorological monitoring. In addition to nonradiological environmental surveillance programs, volatile organic compounds (VOCs) were monitored to comply with provisions of WIPP's HWFP, and liquid effluent monitoring was conducted in accordance to WIPP Discharge Plan criteria.

### WIPP Raptor Program

The WRP was established in the early 1990s to monitor and protect raptors on the WIPP site, and to educate site workers and the public about these birds. The program presently serves four functions: wildlife monitoring, scientific research, community outreach, and interagency cooperation.

### Meteorology

The main function of the WIPP meteorological station is to provide data for atmospheric dispersion modeling. The station measures and records wind speed, wind direction, and temperature at elevations of 2, 10, and 50 m (6.5, 33, and 165 ft). The station records ground-level measurements of barometric pressure, relative humidity, precipitation, and solar radiation.

### Volatile Organic Compound Monitoring

The VOC monitoring program is designed to measure VOC concentrations attributable to hazardous waste disposal units (panels), which are either open and are in the process of being filled or which are full and have been closed. This Confirmatory VOC Monitoring Program was implemented as a requirement of the HWFP, Module IV, Section D and Attachment N, and is intended to demonstrate that regulated VOCs are not being emitted by the waste at concentrations in excess of concentrations of concern (see Table 5.7) as prescribed in the permit.

### Seismic Activity

Currently, seismicity within 300 km (186 mi) of the WIPP site is being monitored by the New Mexico Institute of Mining and Technology (NMIMT), in Socorro, New Mexico, using data from a seven-station network approximately centered on the site (Figure 5.8). Station signals are transmitted to the NMIMT Seismological Observatory in Socorro. When appropriate, readings from the WIPP network stations are combined with readings from an additional NMIMT network in the central Rio Grande Rift.

Occasionally, data are also exchanged with the University of Texas at El Paso and Texas Tech University in Lubbock, both of which operate stations in west Texas.

### Liquid Effluent Monitoring

The WIPP sewage lagoon system is a zero-discharge facility. The entire facility is lined with 30-mil synthetic liners and is designed to dispose of domestic sewage as well as site-generated brine waters. The facility is operated under the conditions of DP-831, and is managed in accordance with EPA sewage sludge regulations, New Mexico Water Quality Control Regulations, and applicable WIPP controlled procedures.

### Groundwater Monitoring

Current groundwater monitoring activities at WIPP are outlined in the *WIPP Groundwater Monitoring Program Plan*. Data obtained by the WIPP Groundwater Monitoring Program supports two major programs at WIPP: (1) the RCRA Detection Monitoring Program, and (2) performance assessments supporting the Compliance Certification Application.

Groundwater monitoring activities during 2001 included groundwater quality sampling and groundwater level monitoring. Groundwater quality data were gathered from six wells in the Culebra member of the Rustler Formation and one well in the Dewey Lake Formation.

### Radiological Dose Assessment

The potential radiation dose to members of the public from WIPP operations was calculated to demonstrate compliance with federal regulations and the DOE's policies and objectives of keeping this dose as low as possible.

### Dose Limits

For more than 50 years, extensive research has been conducted on the effects of radiation on humans and the environment. Much of this research used standard epidemiological and toxicological approaches to characterize the response of populations and individuals to high radiation doses. From this, a good understanding of the risks associated with high radiation doses was achieved. However, there is still uncertainty as to what risks are incurred from low radiation dose and dose rates, so models are used to predict these risks.

### Background Radiation

Radiation is a naturally-occurring phenomenon that has been in the environment since the beginning of time. There are several sources of natural radiation: cosmic and cosmogenic radiation (from outer space and the earth's atmosphere), terrestrial radiation (from the earth's crust), and internal radiation (naturally-occurring radiation in our bodies). In addition to natural radioactivity, small amounts of radioactivity from the

1986 Chernobyl nuclear accident and above-ground nuclear weapons tests that occurred from 1945 to 1980 are also present in the environment. Together, these sources of radiation are called "background" radiation. Every human is constantly exposed to background radiation. Exposure to radioactivity from weapons testing fallout is quite small compared to natural radioactivity and continually gets smaller as radionuclides decay. The average annual dose received by a member of the public from naturally-occurring radionuclides is about 3 mSv (millisievert) (300 mrem) (NCRP [National Council on Radiation Protection and Measurements], 1987).

### Dose from Air Emissions

The National Emission Standards for Hazardous Air Pollutants (NESHAP) issued by the EPA set limits for doses due to radionuclide emissions to air. To determine the potential radiation dose received by members of the public from WIPP, WTS used the computer model CAP88-PC, version 2.0. CAP88 dose calculations are based on the assumption that exposed persons remain at home during the entire year and all vegetables, milk, and meat consumed are home produced. Thus, this dose calculation is a maximum potential dose which encompasses dose from inhalation, plume submersion, deposition, and ingestion of air emitted radionuclides.

### Total Potential Dose from WIPP Operations

The potential dose to an individual from the ingestion of WIPP-related radionuclides transported in water is estimated to be nonexistent. Drinking water for communities near WIPP comes from groundwater sources which are too far away to be affected by potential WIPP contaminants. Groundwater and surface water samples collected around WIPP during 2001 did not contain radionuclide concentrations different from those in samples collected prior to WIPP receiving waste.

Game animals sampled during 2001 were mule deer, quail, fish, and rabbit. The only radionuclides detected, were not different from background levels measured prior to commencement of waste shipments to WIPP. Therefore, no dose from WIPP related radionuclides is estimated to have been received by any individual from this pathway during 2001.

The only pathway for which a dose could be estimated was that of air emissions. Air emissions from WIPP were not considered above background ambient air levels. Estimated concentrations of radionuclides in air emissions accounted for the calculable dose from WIPP operations during 2001.

### Dose to Nonhuman Biota

DOE Order 5400.5 lists the environmental radiation protection requirements that WIPP must meet to protect aquatic animals. In addition, dose limits below which no deleterious effects on populations of aquatic and terrestrial organisms have been observed, have been discussed by the National Council on Radiation Protection and

Measurements and the International Atomic Energy Agency. Those absorbed dose limits are:

- Aquatic Animals 10 mGy/d (1 rad/d)
- Terrestrial Plants 10 mGy/d (1 rad/d)
- Terrestrial Animals 1 mGy/d (0.1 rad/d)

The DOE requires discussion of radiation doses to non-human biota in the Annual Site Environmental Report using the DOE Interim Technical Standard, DOE-STD-XXXX-YR, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota*. The Interim Technical Standard uses a multiphase approach, including an initial screening phase with conservative assumptions.

This guidance was used to screen radionuclide concentrations observed around WIPP during 2001. The sum of fractions was less than one for all media, demonstrating compliance with the proposed rule. Radiation in the environment surrounding WIPP does not have a deleterious effect on populations of plants and animals.

**Quality Assurance**

The fundamental objective of a QA program is to ensure high-quality measurements are produced and reported from the analytical laboratory. The defensibility of data generated by laboratories must be based on sound scientific principles, method evaluations, and data verification and validation. Wastren, of Grand Junction, Colorado; Air Toxics, Ltd. of Folsom, California; and Trace Analysis, of Lubbock, Texas, were the contract laboratories that performed the radiological and nonradiological analyses for WIPP environmental samples. WIPP Laboratories performed the radiological analyses on the environmental monitoring samples.

WTS performed assessments and audits to ensure that the quality of the systems, processes, and deliverables was maintained or improved in 2001.

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